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AN APPRAISAL OF ECOLOGICAL DISTRIBUTION OF HERBACEOUS FLORA AT CHANGA MANGA PARK LAHORE, PAKISTAN

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Abstract

The forest ground flora plays a vital role in cycling of nutrients, habitat preservation and rejuvenation of shrubs. The vegetation consociated with the forest plays a vital role in the protection, function of the forest ecosystem. Effective management of forest vegetation serves the forest ecosystem in assaying the balance of harmful effects of vying vegetation. Relationship of ecology between environment and vegetation and their ordination techniques and classification methods has become vital means in the research field vegetation ecology. Classification depends on the abundances of ground vegetation species. Multivariate technique is an important technique in ecology and biology for the group prediction. Classification of different plant communities had been accomplished by carrying out TWINSPAN analysis using PC-ORD. The results were shown in a two-way cluster dendrogram. A dendrogram is a hierarchical representation of species in graphical form. The encompassing survey has been conducted in the Changa Manga Forest (CMF) which resulted in the identification of the 45 species belonging to 24 families from all over the forest area. The TWINSPAN results of CMF ascertained the following dominant species in all of the four zones, *Cynadon dactylon, Malvestrum cormendalianum, Oxalis corniculata, Parthenium hysterophorus, Desmostachya bipinnata.*

Introduction

With the aim of biodiversity conservation many protected areas has been established in the last century. Conservationists have buttonholed the requirement for protecting forests and other sensitive ecosystems (Anon., 2005). The forest ground flora plays a vital role in cycling of nutrients, habitat preservation and rejuvenation of shrubs (Sharma & Upadhyaya, 2002). The herbaceous ground flora shows high nutrient content. The climatic conditions and vegetation characteristics enhances the abrupt changes (Spain 1984; Vogt & Vogt 1986). The vegetation consociated with the forest plays a vital role in the protection, function of the forest ecosystem and grapples the resources of forest. Effective management of forest vegetation serves the forest ecosystem in assaying the balance of harmful effects of vying vegetation. This depends on the asseveration that the effective alternative for the protection of the biodiversity is the protected areas (Chape *et al.,* 2005). Plant floristic composition and species-richness in grasslands resulted not only by current conditions of site, management and species pool but also by site history, age and customary ancient management practices that might have terminated long ago and use of the particular plant (Pa¨rtel *et al*., 1996; Cousins & Eriksson, 2002; Waldhardt & Otte, 2003; Sebastia, 2004) and also with coppicing, grass cutting, grazing etc due to which plants abundance and growth is affected. Conservationists identified vegetation communities as appropriate units for biodiversity; they are hierarchically on top of individual species but are gathering homogeneous hierarchical data that eases efficient resource stewardship by ascertaining compatibility and extensive use of the data by different individuals and authorities (Grossman *et al*., 1994). Ecological community study heads to incurring immense matrix, which gets difficult for the analysis of making community structure evident. Relationship of ecology between environment and vegetation and their ordination techniques and classification methods has become vital means in the research field vegetation ecology. Classification depends on the abundances of ground vegetation species (Zhang *et al.,* 2006). Establishing nature reserves protects the species, while ecological relationships are protected by ecosystems within the reserves. Multivariate technique is an important technique in ecology and biology for the group prediction (McCune & Grace, 2002). An important quantitative criterion in ecology in identification of different communities is the abundance presence of species in sampling units. For the investigation of the vegetation composition TWINSPAN is widely applied (Charman, 1993; Dzwonko, 1993; Boeye *et al*., 1994; Zhang & Oxley, 1994; Kelly *et al*., 1995; Van De Rijt *et al*., 1996; Rothfritz *et al*., 1997; Franklin *et al*., 1999). Importance of abundance coefficients of vegetation composition can be evaluated by classification. It is also important to cluster releves of high similarity. These releves are important factors that are associated to abiotic variables. TWINSPAN is the computer based program by Hill (1979). Many examples are found in literature which shows the importance of TWINSPAN. For studying the relationship between vegetation and environment, ecologists use the ordination techniques widely. Survey was conducted to study the distribution of plant's community and environmental factors in Chott El Beida wetland, a RAMSAR site in Setif, Algeria. Sixty vegetation plants were selected for the study. TWINSPAN was used as a technique for analysis. The data collected resulted in the observation of 127 species belonging to 41 families and 114 genera. Four main communities were identified. This improves the baseline information of the plant community (Khaznadar *et al.,* 2009).

A survey was conducted of Kirthar National Park's desert vegetation. 466 plant species were recorded in 372 quadrats sample. Using TWINSPAN classification of vegetation identified 10 types of vegetation which consist nine 'natural' and one 'cultural' vegetation types. Differences existed in the composition of species vegetation between mountains, wetlands, riparian vegetation and plains. Distribution of major vegetation

types and species richness is effected by physical environmental factors, which may result in less water availability (e.g. slope angle, rockiness) effecting the plant species and they are more important than human impact factors and soil chemicals (Enrighta *et al.*, 2005).

The study investigates the ameliorative properties of pine cultures at the site on the island of Rab. Pines are pioneer species and they play an important role in progressive vegetative succession so they were used in devastated and afforested areas, on the island. The sample comprised of twelve plots in the forest pine cultures. A multivariate analysis was used for the processing of the data consisting of Two Way Indicator Species Analysis (TWINSPAN). The result obtained exhibited differences among the forest cultures of black pine (Barcˇic´*et al*., 2006).

Hanna Lake's natural vegetation was surveyed. Hanna Lake was divided in two zones for the conduction of the study and clear communities' demarcations. TWINSPAN was used for analyzing and classifying vegetation data into plant communities. 40 quadrats were used for data collection of the result. Thirty eight species were recorded in zone 1 belonging to 16 families. While 36 species were recorded in zone 2 belonging to 16 families. TWINSPAN demarcated two major four sub-communities in both zones.a baseline data was provided by the study (Ahmad &Yasmin, 2011).

Road side vegetation of motorway (M-2) was surveyed. Braun-Blanquet's approach was undertaken and phytosociological survey was carried out in the study. TWINSPAN was used for analyzing floristic data for the classification and provision of baseline information. TWINSPAN recognized two major and 16 sub-communities. The Floristic data was collected by using quadrats. 397 quadrats were used and recorded 227 vascular plants species which belonged to 75 families. The whole study area was divided into two major communities by the TWINSPAN, which were further divided into 16 sub-communities. Basic information is provided by the study for the implementation of conservation oriented strategies, planning and management or the preservation and improvement of the road verges of M-2 (Ahmad, 2010).

The aim of the present research was to bring to light the importance of herbaceous flora of the study area by employing ordination classification technique. The results will aid in developing better management practices and for future surveys will be aimed with the conservation of this valuable creation of the nature in Changa Manga forest park.

Materials and Methods

Study area: The Changa Manga lies in Latitude of 31.0833° North and longitude of, 73.9667° East extending to the area is 50 km² (12,510 acres).it is now maintained as national park and one of the biggest planted artificial resource managed forest in Kasur district, Pakistan. (Changa Manga Railway Forest, 2007). It is located near Chunian which is about 70 km south of Lahore. The forest entrance is from a road of Highway which is N-5 near Bhai Pheru. In the beginning it was planted on the uncultivated land densely populated with trees and bushes in 1864 for the provision of fuel wood for the steam engine operative from Peshawar to Karachi (Khan, 1962). Since then proper systematic planting of the trees is going for many years. The most important trees that are being planted there are *Dilbergia Sisso* (Shisham), *Torus Alba* (Tooth), *Bombax Malabarium* (Simbal), *Acacia Nilotica* (Kikar), *Populus Tremula* (Popular). The surrounding of Changa Manga forest (CMF) has extreme climate, with high temperature in the summer and low rainfall. But due to dense population of the trees the temperature in Change Manga forest is comparatively low to its surrounding and has high humidity which results in providing the favorable environment for the plants to prosper creating an ecological island; consisting of such herbaceous plants which are economically very important for the mankind.

The CMF covers total area of 12,510 acres. As this the large area so CMF was divided into four zones in such a way that it covers the whole of the forest.

Zone-I: Zone-I was Pattoki Road, Wankhara boundary covering 70 acre. Dry scape was present in that area which purpose was to store the excess water left from the irrigation provided to the artificially planted trees in the CMF. Pattoki Raiwind road was passing by along the boundary. 10 species were identified in that area.

Zone-II: Zone-II was Boihasil boundary at the east of the CMF. Much of the area was in accessible. Crops were cultivated near this boundary. Deforestation was observed in that area. Timber looters were seen cutting the trees illegally. 5 herbaceous species were found in this area.

Zone-III: Changa Manga forest park was demarcated as zone-III. This covers much of the area of the CMF. Main constructed road passes through the forest park. Many dry scapes were present at the entrance of the park for storing of the excess water. A zoo was constructed for the wild life preservation, along with resort for the visitors. A lake called Mehtabi Jheel was made for the tourists' attraction which surrounds whole of the main park area. Grazing was seen at the entrance of the forest park which has been legally allowed by the forest administration officers. Many swings were present for the entertainment of the people which resulted in the total loss of the plants at those areas.

Zone-IV: Chunian road entrance was designated as the zone-IV. This area was near the start of the Chunia Cantt that is why it was named as Chunian road entrance. Chunian road extending from Chunian towards the M-2 at Bhai Peru passes between this zone-IV. Data was collected from both side of the road. Total 23 species were found. Human encroachment, mass grazing, and illegal timber cutting was found in that area.

Random sampling technique was assayed for the collection of floristic data by following Braun-Blanquet approach. Total 200 quadrats of 1m x 1m were laid down in whole of the forest. Zone-I consisted of 31 quadrats, 33 quadrats were laid in zone-II, zone-III consisted of 79 quadrats while 55 quadrats were undertaken in zone-IV. The cover estimation was recorded by the "DOMIN" scale (Kent & Coker, 1995). Data analysis requires both classification and ordination techniques on the data set.

TWINSPAN (Hill, 1979) (Two Way Indicator Species Analysis) was run by using software, PC-ORD. this was used as tools for the development of classification for floristic data and vegetation types. This analysis was used because Two Way Indicator Species Analysis is a polythetic divisive classification model.

Results

Classification of different plant communities had been accomplished by carrying out TWINSPAN analysis using PC-ORD which showed the results in a Two-Way cluster dendogram. Dendogram was interpreted. A dendogram is a hierarchical representation of species and stands in graphical form.

Each of the CMF represents the main group which further divides into communities formed by the association of different plant species. Figures 1 and 2 are showing classification results of the different zones of study area respectively.

Figure 1 represents the zone I. the diversity of species seems less in this zone. This zone is divided into the two main groups. The group I is further expanded into sub divisions, while group II is not further dissevered. Community I belonging to group I consists of two species i.e., *Parthenium hysterophorus* and *Sisymbrium irio*. The name allotted was *Parthenum-Sisymrium (Par-Sys).* Community II has been designated as *Rumex-Malvestrum* (Rum-Mal), *Rumex-Mentha* (Rum-Men) or *Rumex-Conyza* (Rum-Con) because of the dominant species *Rumex crispis* and *Malvestrum coromendilianum, Mentha spicata, Conyza bonariensis. Malvestrum coromendilianum, Mentha spicata, Conyza bonariensis* have the same diversity in this area. The most diverse specie in this zone is *Cynaon dactylon* which is making the Group II in this zone.

Zone II has been shown in Fig. 1. The zone has been dissevered into two main groups. Group I is leading to subdivision while group II remains undivided. The community I divides into two portions the left hand side remains undivided while the right hand side is further divided. The dominant species are *Astrgolus uliginosis* and *Prosopis cineraria.* The name dispensed to this community is *Astragolus-Prosopis* (*Ast-Pro*). The dominant specie at the left side division of the group I is *Parthenium hysterophorus* and it is diverse in whole of the zone. The dominant specie at Group II is *Desmostachya bipinnata.*

Figure 2 shows zone III, Which is the Changa Manga forest park area. This zone is divided into two major groups i.e., groups I and groups II. Single species is forming groups I while group II is further divided into 8 subgroups. The prominent specie in groups I is *Cynadon dactylon.* Community I of Group I consists of *Parthenium hysterophorous* and *Sonchus arvensis* as the dominant species. The name given on the basis of dominancy was *Parthenium- Oleraceous* (*Par-Ole*). The affiliated species were *Sysimbrium irio.* The dominant species in community II were *Panicum antidotale* and *Sonchus arvensis.* The name of this group was *Panicum-Arvensis* (*Pan-Arv*). Community III has dominant species *Ranunculus muracatus* andT*taraxacum officinale.* The name *Ranunculus-Taraxacum* (*Run-Tar*) was provided to this group. Consorted species were *Lippia nodiflora* and *Desmostachya bipinnata. Oxalis coroculata* has the diverse presence in this zone but it does not form any associated group with the species. It was divided to the left hand along with the community III to the right. So it may have some association with the community III. Cmmunity IV shows *Poa annua* and *Chenopodium album* as the dominant species. It earned the name *Poa-Album (Poa-Alb)* because of the two dominant species.the associated species were *Euphorbia heloscopia* andC*cannabis sativa. Malvastrum coromendalianum* and *Cenchrus agrmonioides* dominates in the community V. Due to this dominancy the name of the group was provided as *Malvastrum-Cenchrus (Mal-Cen).* Concorded species were *Mentha spicata, Convolulus arvensis, Chenopodium murale, Eragrostis poaeoides* and *Ayapana triplinervis.* Community VI consists of two species i.e *Prosopis cineraria* and *Anaglis arvensis.* The name recommended is *Prosopis-Anaglis (Pro-Ana). Veronica arvensis* showed the presence in this zone. In the dendogram it is between the community VI and VII so it means it is showing somewhat association with both of the groups. Community VII consists of only two species i.e *Stellaria media* and *Ageratum conyzoid.* It was named as *Stellaria- Ageratum (Ste-Age). Convolulus arvensis* and *Cirsium arvense* were the two species present in community VII and *Convolulus-Cirsium (Con-Cir)* was the name rendered to this community.

Figure 2 refers to the zone IV of the Change Manga forest. TWINSPAN analysis has divided this zone into two main groups. Group I is further subdivided into four minor community while group II is not. In community I of the group I, the dominant species are *Conyza Canadensis* and *Erigonum deserticola*. So the name assigned to this community is *Conyza-Erigonum (Con-Eri).* Associated specie was *Zizipus numularia*. The community II is the conglomeration of three species. The major two species were *Malvestrum cormendalianum* and *Mentha spicata.* So the given name of this conglomerating was *Malvestrum-Spicata (Mal-Spi***).** Associated specie was *Acharanthes aspera.* Community III of Group I was diverse consisting of wads of species. The dominant species among them were *Chenopodium murale* and *Oxalis corniculata.* The community was given the name *Chenopodium-Oxalis (Che-Oxa).* Associated species were *Coronopus didymus, Prosopus cineraria, Dathura stramonium, Galinsoga ciliate, Convolulus arvensis, Aerva javanica, Abutilon theophrasti, Calatropis Procera, Cleome viscose, Fumairia officianalis. Chenopodium album* and *Desmostachya bipinnata* are the dominant species in community IV, thus it earned the name *Chenopodium-Desmostachya (Che-Des).* The associated species were *Cannabis sativa* and *Capparis deciua.* The dominant specie in group II is *Cynadon dactylon* and it does not share its dominance with any other species in that group.

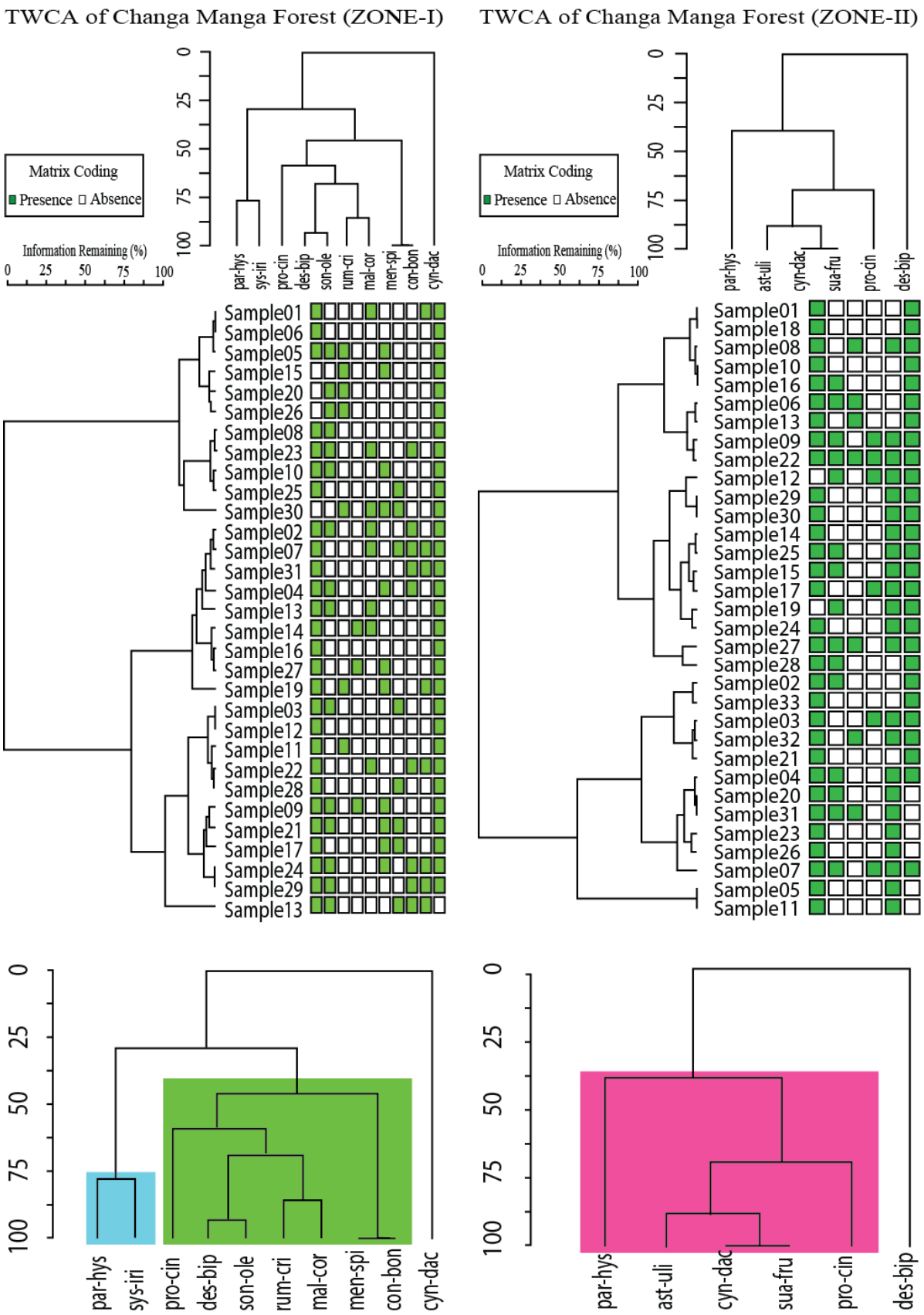

Fig. 1.TWINSPAN classification (based upon presence and absence of species) in Zone-I and II.

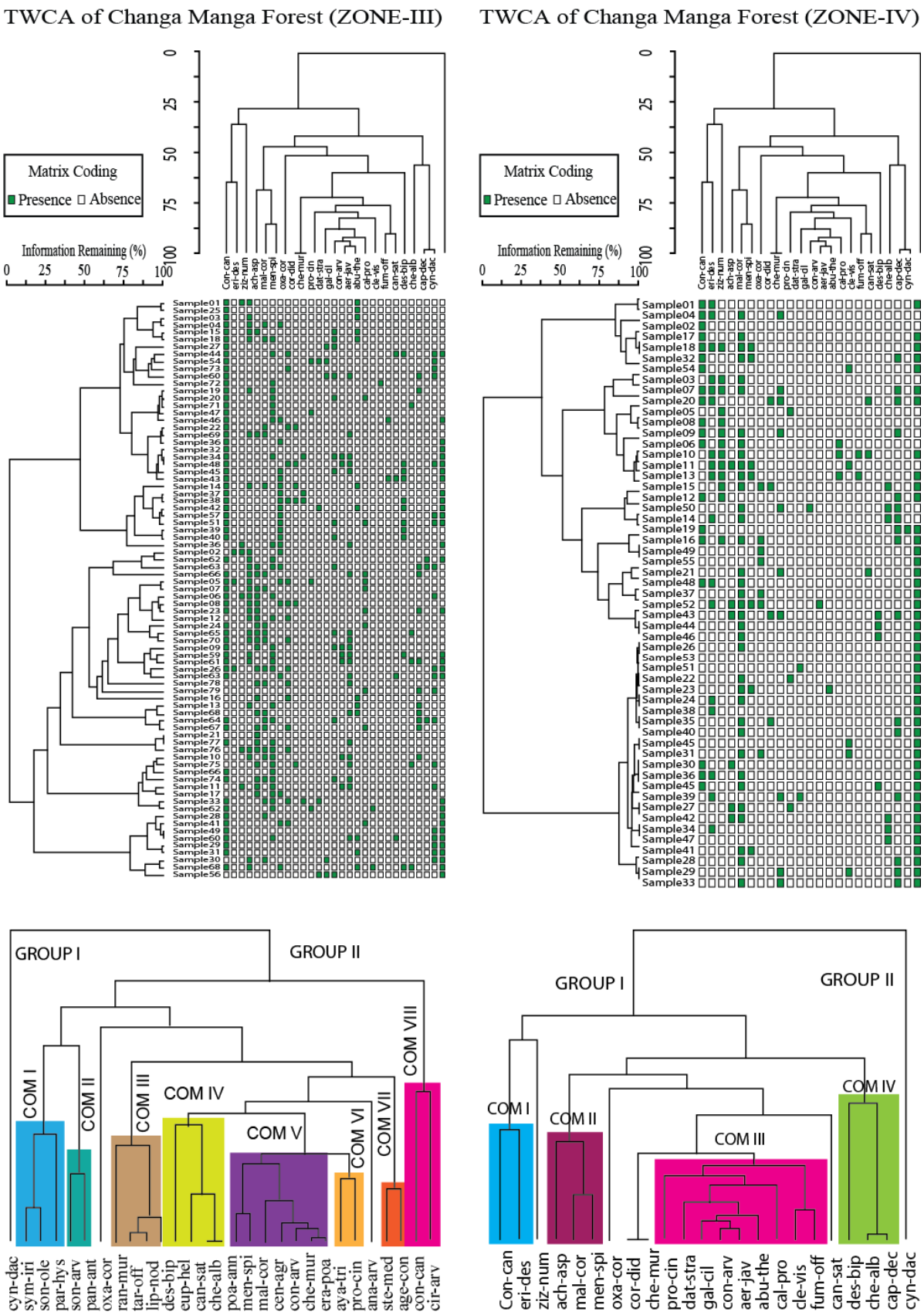

Fig. 2. TWINSPAN classification (based upon presence and absence of species) in Zone-III and IV.

Discussion

The encompassing survey has been conducted in the CMF (CMF) which resulted in the identification of the 45 species belonging to 24 families from all over the forest area. For the analysis of the species multifariousness and ascendancy TWINSPAN analysis has been conducted which plied the results in the form of two way cluster Dendogram. No meticulous research regarding the herbaceous flora of the CMF has been conducted so far although this forest is of eminent importance as this is the world's biggest artificial planted forest. This forest is also prone to high grazing pressure and biotic interferences as it is located near to the environs of heavily populated city, Lahore and increasing commercial and urban development's.

Weeds are usually thought to be harmful and undesirable plant species which intervene with crop plants but in reality they provide functional importance in the agro-ecosystems. They enhance the floral diversity, and raise the phenomenon of photosynthesis in the area. They also furnish as the substituted resource for phytophageous insects and circuitously serves beneficial role for zoophagous arthropod species in the absence of their preferred crop plants (Norris & Kogan, 2005) and they also can serve cures to many ailments of the human body so because of their so many vantages their evaluation was very necessary. Such use of plants is usually very common in the rural area as compare to the urban area.

Conservation should be provided if they are being over exploited. Same study was implemented for the distribution, growth, correlation and classification of herbaceous vegetation edaphic factors in Margalla Hills National Park. The aim was to identify and classify the plants species that playing important role in community composition (Ahmad, 2009). Malik and Husain (2006) did Two Way Indicator Species Analysis (TWINSPAN), plant community. The result presented the characteristic plant species of each community type together with the entropy on dominance and sub-dominance species. The study led to the recognition of four plant communities which were results obtained from the classification and ordination techniques based on the floristic composition. The CMF was divided into four zones. The TWINSPAN according to different zones was carried out. TWINSPAN divided the zone-I into two minor communities while zone-II was classified into one community. Zone-III and zone-IV was divided into eight and four communities respectively. The TWINSPAN results of CMF ascertained the following dominant species in all of the four zones, *Cynadon dactylon, Malvestrum cormendalianum, Oxalis corniculata, Parthenium hysterophorus, Desmostachya bipinnata*. *Cynodon dactylon* is a warm-season, perennial herb which is very much tolerant to hot and dry climatic conditions. It has the potency to spread and increase quickly (Guertin, 2003). *Cynadon dactylon* is commonly disturbed in gardens, road, overgrazed, trodden areas, and fallow lands localities. It occurs in damp areas but has shown no tendency to spread into the drier areas, (Holm *et al*., 1991). it is well accommodated persisting environmental conditions. Its dispersion can be due to water particularly irrigation, agriculture and soil movement. (Anderson, 1999; Newman, 1992) that is why it shows elucidated dominancy in 3 out of four zone of the CMF.

Cynodon dactylon and *Malvastrum coromandelianum* exist in association at particular places without giving preferences to a specific habitat. (Ahmad, 2010) and this association has been shown in zone IV where dominancy has been shown by these two species. *Malvastrum coromandelianum* is a weed of wet, low land pasture and non crop areas (Motooka *et al*., 2003). It is very much tolerant to herbicides and this tolerance may have enhanced the chances of surviving in the CMF and this can be the reason for its dominance in the CMF.

Oxalis corniculata occurs predominantly in highly disturbed habitats and urban. It is confined to garden, lawns and green houses (Holt, 1987) and CMF habitat was favourable for its growth as it fulfills all the requirements needed for *Oxalis corniculata.* The germination of *Parthenium hysterophorus* normally occurs in spring and early summer. With the desirable conditions such as rain, mild temperatures, it can grow at any time of the year. It is grows well in moist soil but it dominates in alkaline, clay loamy soils. In Pakistan, *Parthenium hysterophorus* is scattering sharply in degraded areas, wastelands, along water channels, roadsides and railway tracks. It has also been reported in cultivated lands (Shabbir, 2002). It has been found dominating in two zones of the CMF. And these two zones mainly consist of cultivated land nearby, along with the water in the dry scape. Shabbir & Bajwa (2007) surveyed the sectors G-7 and G-11, and found that *Parthenium hysterophorus* and *Desmostachya bipinnata* shows prominent sociability which has been seen in the zone-II of CMF.

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